

Waves on a String

https://phet.colorado.edu/sims/html/wave-on-a-string/latest/wave-on-a-string_en.html

LAB REPORT: Type or hand write the answers to the observations and questions in this lab report in a separate document. Convert your final document to a PDF and submit into your Google Drive Physics Shared Folder.

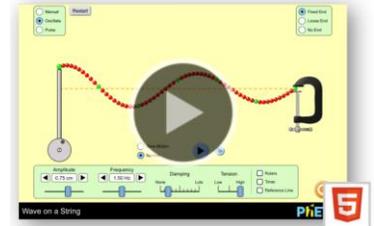
- Include the number of the question and then the answer, calculations, Data Table, etc.
- If you type - for drawing, calculations, graphs, etc., scan images of these into your document. Save your final work as a PDF and save it to your Google Drive Physics Shared Folder.
- If you hand write - scan your work as a PDF and submit into your Google Drive Physics Shared Folder.

TO BEGIN: Click the link above or go to the PhET site (<http://phet.colorado.edu>) and launch *Waves on a String*

Basic operating instructions:

- If you ever need to stop the wave motion altogether, hit "Restart," not the orange "Reset" button.
- You may leave units as cm or cm/s
- For all directions leave the damping on "None"

Wave on a String



PART A: THE SPEED OF A WAVE

- Explore the simulation to get a feel for it.
 - Explore all the controls you can modify.
 - Pay special attention to all the ways you can make a wave and the effects of using the normal vs. slow-motion button
 - See how to use the blue pause/play button. Learn what differences the damping and tension buttons make.
- Set up the sim by selecting Oscillate, No End, set the Damping to None, and check the Ruler and Timer
- Test the effect of the following variables on the speed of a wave and record your observations and conclusions in a table similar to the one below using the following table or a table that you create:

Action (What did you do?)	What changed?	How did it change? (Provide at least two calculations to back up your conclusion.)	Relationship
1) _____ Frequency	<input type="checkbox"/> Speed <input type="checkbox"/> Frequency <input type="checkbox"/> Wavelength		<input type="checkbox"/> Direct <input type="checkbox"/> Inverse <input type="checkbox"/> None
2) _____ Wavelength	<input type="checkbox"/> Speed <input type="checkbox"/> Frequency <input type="checkbox"/> Wavelength		<input type="checkbox"/> Direct <input type="checkbox"/> Inverse <input type="checkbox"/> None
3) _____ Tension	<input type="checkbox"/> Speed <input type="checkbox"/> Frequency <input type="checkbox"/> Wavelength		<input type="checkbox"/> Direct <input type="checkbox"/> Inverse <input type="checkbox"/> None

PART B: INVESTIGATING PULSES

- Reset the sim
- Set up the sim by selecting Manual, Fixed End, Tension set to High, and set the Damping to None
- 4) Send a pulse down the string. Check the Reference Line box to help guide your pulse
 - a. Draw the pulse and the reflected pulse
 - b. Does the reflected pulse have the same displacement as the incoming pulse, or was it inverted?
 - c. Make a complete statement about what is happening, using the terms "incident" and "reflected"
- 5) Switch the end to "Loose"
 - a. Draw the pulse and the reflected pulse
 - b. Does the reflected pulse have the same displacement as the incoming pulse, or was it inverted?
 - c. Make a complete statement about what is happening, using the terms "incident" and "reflected"

PART C: INTERFERENCE

- Reset the sim
- Set up the sim by selecting Pulse Mode. Set the Amplitude to the largest possible value, and the Pulse Width to the largest possible value. Make sure Damping is None, and Tension is Low.
- Send a pulse down the string. When it reaches the other end, send another pulse down the string.
- 6) Switch to Slow Motion and try to hit pause at the exact moment when the pulses overlap.
 - a. Draw what this interference looks like below, at the moment of complete overlap.
 - b. Was this interference constructive or destructive?
- Restart, but this time select "Loose End"
- Send a pulse down the string. When it reaches the other end, send another pulse down the string.
- 7) Switch to Slow Motion and try to hit pause at the exact moment when the pulses overlap.
 - a. Draw what this interference looks like below, at the moment of complete overlap.
 - b. Was this interference constructive or destructive?

PART D: STANDING WAVES

- Reset the sim
- Select Oscillate Mode. Keep Tension on High, Fixed End, but switch Damping to None
- Watch this wave for one minute. Is a standing wave created with the preset values?
- 8) Find the frequency that would result in standing waves with the following number of antinodes. Fill in the table with your data. *(The last two columns with harmonic info are just an FYI for later. Your welcome.)*

Number of Antinodes	Frequency (Hz)	Wavelength (cm)	Draw the wave produced	Harmonic	
1	0.40 Hz			First	f_1
2				Second	f_2
3				Third	f_3
4				Fourth	f_4

- Finally, just for fun, select Oscillate Mode. Keep Tension on High, Damping to None, and set to FREE end ☺